



Research Undertaken to Advance  
Factory-Built Housing

# MAXIMIZING Performance MINIMIZING Costs

# 6 TOP RESEARCH INITIATIVES

BY JORDAN DENTZ

**H**ow do you optimize product performance; mitigate moisture problems; improve energy efficiency; save time and money in manufacturing; develop new cost-effective foundation systems; advance the professionalism of installers and inspectors; and, build the asset value of manufactured homes in just five years?

These are the core goals for factory-built housing research identified by the Manufactured Housing Research Alliance (MHRA) Roadmapping Committee. Six research projects stemming from these goals have been put forward for immediate funding consideration (see related story, *Six Top Research Initiatives*).

## WHEAT FROM THE CHAFF

The projects were identified over the last year by committees and interest groups that provided advice and prioritized research and development (R&D) efforts through a process called "Roadmapping."

Under the MHRA umbrella, this process has brought together key industry stakeholders, including home manufacturers; retailers; community owners and managers; trade contractors; material and product suppliers; financial industry representatives; architects, planners, consultants and engineers; codes and standards officials; power suppliers; and public agencies.

The effort follows on from a previous effort described in *Technology Roadmap for Manufactured Housing*, a report released in March 2003, which provided an overarching structure for thinking about and formulating research related to factory-built homes.

The latest version expands on the original by suggesting a broad array of research initiatives. It contains 65 concepts for research, which was culled from an original list of over 100 recommendations. The final six concepts, slated for immediate funding, were chosen by the Roadmap Committee chaired by Ed Bryant of Champion Enterprises.

## RESPONSIVE RESEARCH

HUD's office of Policy Development & Research, among other government agencies, will view the roadmap as a primary filter when considering funding for manufactured housing-related research.

## 1 IMPLEMENTING LEAN PRODUCTION

Lean production methods were developed and refined in the auto industry, but have recently been adopted across all types of manufacturing and service industries.

In the industries that use it, lean production has substantially improved production efficiency and quality, while reducing waste in time, materials and other resources.

Factory homebuilders are fairly new to lean, but it's a perfect fit for many plants. As a first step in helping home manufacturing plants to evaluate the benefits of lean methods, MHRA conducted a nationwide benchmarking study to serve as the foundation for future efforts to improve the efficiency of factory home building (see some of the results in this survey in *Technologies*, p. XX).

"The results of the study highlight large variations in plant performance across the industry. There is no shortage of opportunities for industrial engineers to improve factory built housing productivity and quality," said Alan Sheaffer, an industrial engineer with Fleetwood Enterprises.

Industrial engineers analyzing the recent industry-wide benchmarking study suggest that home manufacturers should be able to realize productivity improvements on the order of 30 percent or more.

Future research would include developing and implementing a program to coordinate the application of lean tools in representative plants and overcome the main barriers to lean manufacturing practices.

Lean potentially impacts all aspects of manufacturing, including warehousing; managing inventory; replenishing products

“The Roadmap process is an effective way to develop research priorities that are responsive to the long-term business needs of individual companies..., provides superior products and services to the end customer (homebuyers) and benefits the public good,” said Dave Engel, director of HUD’s Office of Policy Development and Research.

## RESOURCES FOR INNOVATION

The role of MHRA is to harness the knowledge, experience and talents of companies and individuals in the industry, and then form strategic partnerships with public and private sector orga-

nizations that share a common vision. All of this allows the industry to facilitate research that accomplishes ambitious goals.

The partnership model provides a focal point on which companies can collaborate on common research goals since no one company has the resources to undertake many of these ambitious projects alone.

Equally important are the long-term partnerships with federal agencies that help fund deserving research programs. For example, the Department of Housing and Urban Development’s Partnership for Advancing Technology in Housing (PATH) program is an example of a partnership that is well

# 6 TOP RESEARCH INITIATIVES

and materials in the plant; labor relations and responsibilities, and even product development. Looking beyond the plant, lean techniques also have the potential to radically improve the entire home delivery system, boosting profits at the retail level and making the homebuying process far more satisfying for the customer.

## 2 ADVANCING FOUNDATION DESIGN

Several tried-and-true methods are used to secure manufactured homes to the ground.

The most common is piers that rest on surface-mounted footings. To a lesser extent, floating slabs and concrete footings that extend down to the frost line are used by some retailers and communities. In most homes, the crawl space between the home and the ground is unconditioned and generally enclosed by vented skirting.

There are other approaches that might prove to be more cost-effective, durable and result in improved thermal performance.

For example, recent research by the site-building home community has suggested that conditioned crawlspaces have energy and moisture performance advantages. And in site-built construction, frost-free shallow foundations that eliminate the effects of frost heave without the excavation cost are beginning to be used successfully.

Research would evaluate and develop alternative foundation and support systems that would provide superior performance

yet maintain the cost effectiveness that are key maintain affordability.

“Heavier homes, real estate financing, multiple natural hazards and maintaining affordability: these and other considerations are causing us to focus on how our homes are installed at the home site,” said Bill Farish, director of engineering for Fleetwood Enterprises.

“This is fertile ground for real innovation,” he said.

## 3 MINIMIZING SERVICE COSTS

With costs per home for post-installation service running well over \$1,000 per home on average, the industry is routinely and arguably unnecessarily shelling out nearly 4 percent of the cost of the average manufactured home to repair problems created after the home leaves the factory.

To a great extent, the kinds of issues that result in service calls can be prevented by changes in home manufacturing, delivery and set up. The goals of this research would be to:

- Understand the types of stresses materials and systems are subject to during home manufacture, transport and installation;
- Review and analyze material and product performance deficiencies from manufacturer service records, warranty claims and consumer complaints;
- Establish relationships between service life and product characteristics;
- Estimate the cost of premature product and system degradation; and,

• Develop manufacturing, transportation and installation techniques and new component designs to minimize premature failures.

“Our goal is to substantially reduce or effectively eliminate service and warranty costs and minimize homeowner maintenance costs without adding cost at the production end. This might sound unrealistic but it is exactly what has been achieved by modular manufacturers in Sweden using similar building techniques,” said Dennis Jones, President of the R-Anell Housing Group.

## 4 IMPROVING INSTALLATION QUALITY

While the quality of the home delivered to the buyer is paramount, delivering that home on time and on budget requires a team of knowledgeable companies—manufacturer, transporter, retailer or builder and installer—capable of working together and effectively communicating.

Unfortunately, the home sales and delivery process is often too fragmented with incomplete information exchange among the partners involved in the process. In particular, the retailer, who generally coordinates the process on behalf of the buyer, must ensure that all steps are completed properly from the time the home leaves the plant through turnover to the buyer.

In order to do this effectively, the retailer depends on a number of things: knowledgeable, experienced, installers; clear documentation of installation require-



## Energy Roadmap

Working in parallel with the Roadmapping Committee, a separate committee also comprised of industry and public sector representatives formulated factory-built housing research needs related to advancing energy efficiency goals. Improving energy performance has a special emphasis in the current environment of rapidly rising energy prices and is a major contributor to improving home affordability. The Energy Roadmapping Committee, under the leadership of Mark Ezzo (Clayton Homes), outlined an ambitious program that will move manufactured housing to Energy Star levels and beyond within the next decade.

positioned to help reach industry goals. The mission of PATH is to encourage innovation in housing technology and speed it to the marketplace, a mission that meshes well with the industry's goals and capabilities.

The positive results from past cooperative research with PATH and other federal programs has yielded measurable results, with projects such as air distribution systems, moisture mitigation and improving foundation systems moving factory-built housing substantially forward.

To download a free copy of the MHRA Roadmap, visit the Web site at [www.mhrahome.org](http://www.mhrahome.org). ■

ments; prompt and accurate information from plants; and most importantly, a management system to navigate the myriad of details. When one or more of these items are lacking installation quality may suffer.

Two activities are underway to help improve the efficacy of factory home building, including:

- The Manufactured Housing Educational Institute (MHEI) has an installer training program to improve the skill sets of installers.
- MHRA will soon begin development of a model manufacturer's installation manual to assist plants in providing clear, consistent guidance to installers.

The proposed research will tie these and other elements together into an integrated home purchase, delivery and construction management system that facilitates clear and timely communication among all parties and assists the retailer in coordinating the entire process. Among the products of the research will be an electronic and/or paper-based information management system that facilitates timely and effective exchange of information between retailers, manufacturers and installers.

"Installation quality is critical to so many sectors of the industry, including lenders, manufacturers and retailers, not to mention the importance to homeowners. An integrated construction management system will help retailers do one of the most difficult aspects of their job," said Don Glisson, CEO of Triad Financial Services.

## 5 MANAGING MOISTURE

Not surprisingly, all types of structures in hot, humid climates are more prone to moisture problems. Routinely building homes free of moisture problems has proven to be elusive because moisture condensation is the result of a complex interaction of so many factors: air flow, HVAC operation, building layout, occupant lifestyle, material properties, etc. As a result, engineering a home to achieve a moisture balance is a challenge.

MHRA has initiated a multi-year research program to pinpoint likely causes of moisture problems in manufactured homes in hot, humid climates and develop, test and share solutions.

This effort will cap off many years of research undertaken to tackle this problem. It will recommend, describe and rank the most important manufactured home design, construction, installation and operation strategies to avoid moisture problems focusing on climates that are hot and humid for much of the year, like the Gulf Coast.

In the next and last phase of the effort, researchers will identify diagnosis and retrofit techniques for moisture problems in homes located in hot, humid climates.

"In particular, we initially underestimated the importance of a building's air flow to moisture control. By managing air movement proactively, we can dramatically cut down on the occurrence of damaging moisture problems in our homes," Mike McKittrick, market manager of Alcan Composites Inc., and chair of MHRA's Moisture Research Committee.

One product of the research will be moisture-mitigation guidebooks for manufacturers, installers and service technicians. The guidebooks will consolidate the research into a set of guidelines to prevent moisture problems in manufactured homes and help service staff address problems that crop up in the field.

## 6 BUILDING ASSET VALUE

Wealth creation through home equity is often the cornerstone of long-term financial stability for many low- and middle-income families.

Since manufactured housing provides one of the most affordable options for homeownership, its ability to increase in value is a critical necessity for many Americans.

The research would focus on collecting empirical evidence to characterize the conditions required for manufactured homes to contribute to long-term wealth creation.

An example of a program designed to assist homeowners create wealth is the *I'm Home Program*, an effort supported by the Ford Foundation and other promoters of affordable housing.

This initiative provides resources to local non-profit community organizations to construct manufactured home developments that are then sold to low-income residents.

A copy of the MHRA Roadmap can be downloaded from [www.mhrahome.org](http://www.mhrahome.org). ■